

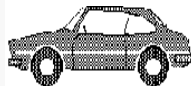
# Analysis of Air Toxics Emission Inventories for Area Sources in the Great Lakes Region



Great Lakes



Toxics



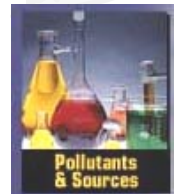
Cars



Trucks



Fuels



Pollutants  
& Sources



# Introduction

- ◆ Great Lakes Regional Emission Inventory
  - ◆ Initiated in 1986
    - ◆ To foster cooperation among the Great Lakes states in quantifying the loading of toxic substances
    - ◆ Funded by



**Environment  
Canada**

# Introduction

- ◆ Great Lakes Regional Emission Inventory
  - ◆ Client/server software
    - Regional Air Pollutant Inventory Development System (RAPIDS)
  - ◆ 1993 Inventory - 03/1999
    - ◆ Area and point sources
    - ◆ 49 pollutants
  - ◆ 1996 & 1997 Inventory - 02/2000 & 04/2001
    - ◆ Area, point, and mobile sources
    - ◆ 82 pollutants

# Introduction

## ◆ Area Sources

- ◆ Stationary sources not included in point source category
- ◆ Small and ubiquitous
- ◆ Collectively release large amounts of emissions
- ◆ Pose significant threat to public health in urban areas
- ◆ Lack of appropriate guidance and resources on the emission estimation

# Methodology



- ◆ Regional Effort

- ◆ High level of coordination - consistency

- ◆ Information collection

- ◆ Methodology

- ◆ Data management

- ◆ Others

- ◆ Great Lakes Commission - project management

- ◆ Technical Steering Committee

# Methodology

- ◆ Select Potential Source Categories
  - ◆ Emission Inventory Improvement Program (EIIP)
  - ◆ Factor Information Retrieval (FIRE) Data System
  - ◆ 1996 National Toxics Inventory (NTI)
  - ◆ Previous regional/state inventories
  - ◆ Others
- ◆ Examine the Feasibility and Develop Protocols
  - ◆ Each state or province - one or two categories
  - ◆ 16 categories - inventoried for 1996 & 1997

# Methodology

- ◆ Compile the Inventory
  - ◆ Each jurisdiction - respective portion
  - ◆ Guidance of protocols
    - ◆ Identification and location of emission sources
    - ◆ Identification of possible pollutants
    - ◆ Recommendation of suggested and alternative methods
    - ◆ Activity data collection
    - ◆ Recommendation on emission factors
    - ◆ References
- ◆ Quality Assurance and Quality Control
  - ◆ State-level and regional level



<http://www.glc.org/air/1996/1996.html>

[http:// www.glc.org/air/air3.html](http://www.glc.org/air/air3.html)



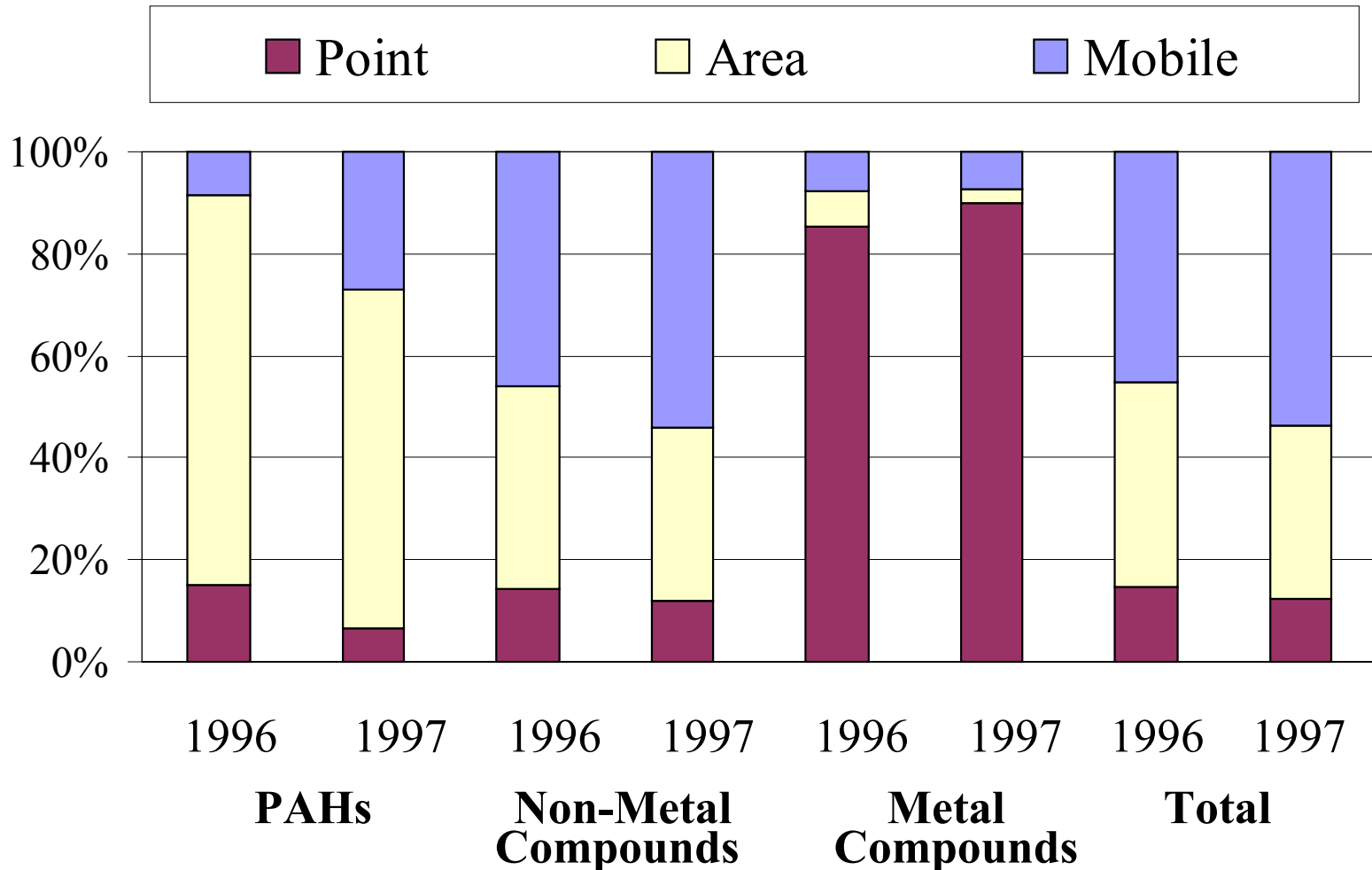
# Results and Discussions

## ◆ Overall

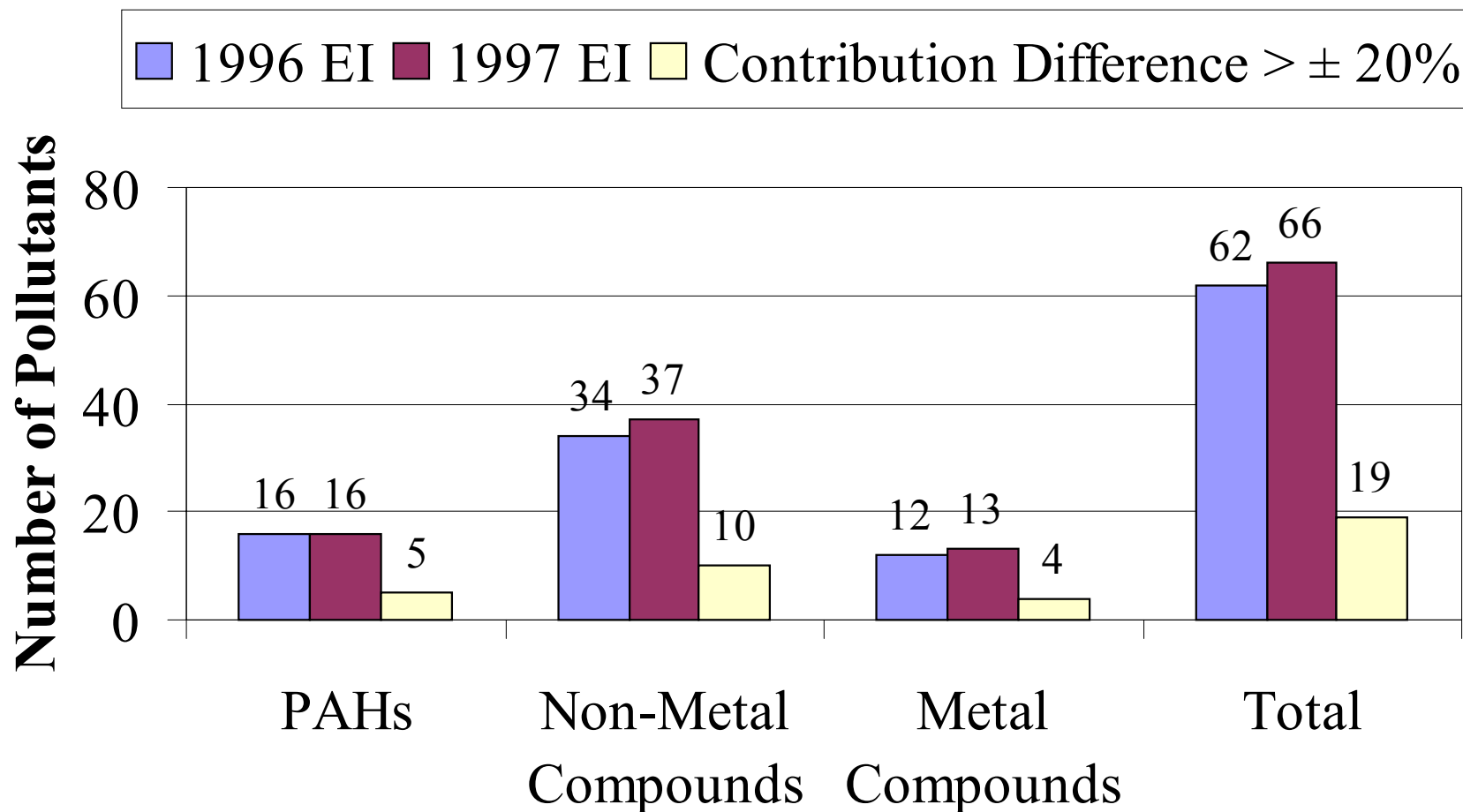
Number of pollutants in inventories

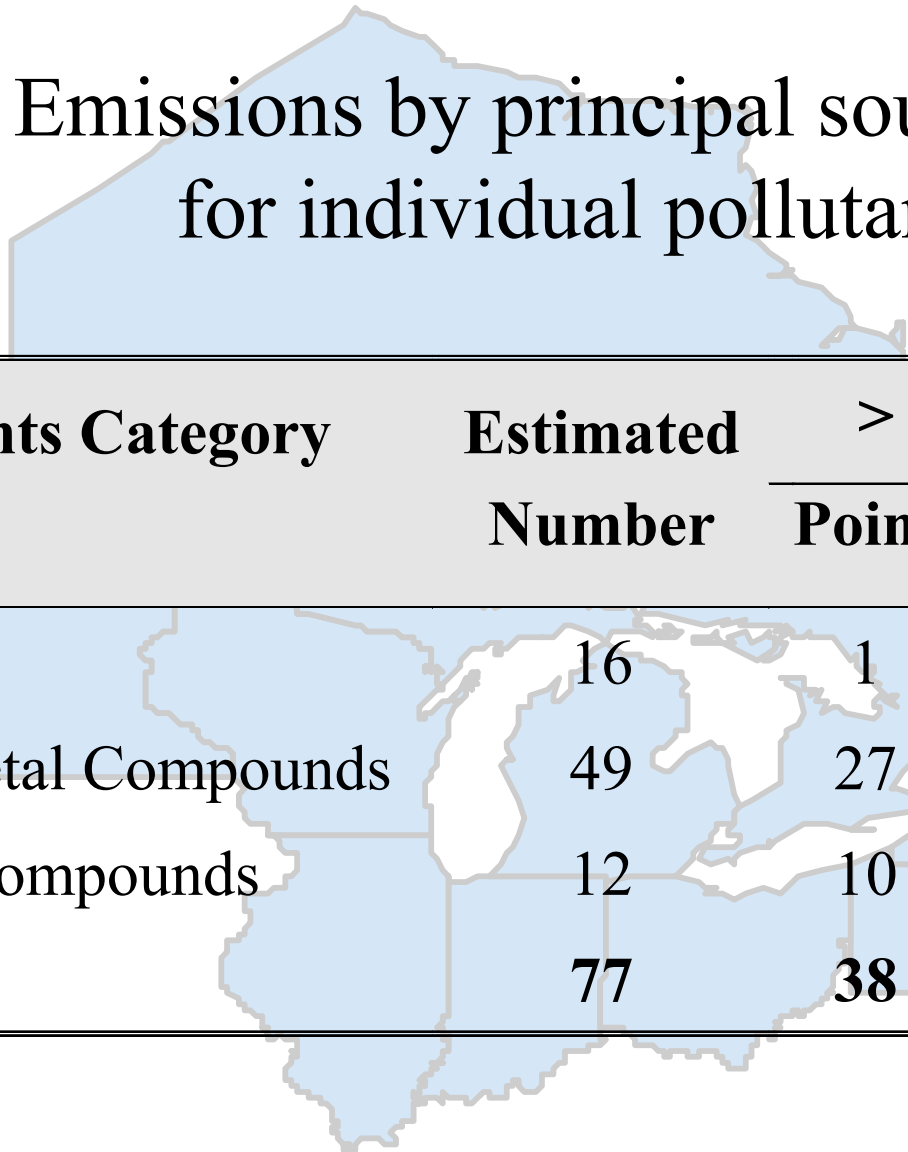
Pollutants Category	Targeted Number	Estimated Number In 1996	Estimated Number In 1997
PAHs	16	16	16
Non-Metal Compounds	53	49	47
Metal Compounds	13	12	12
<b>Total</b>	<b>82</b>	<b>77</b>	<b>75</b>

# Emissions by principal source category



# Comparison of Area Source Emissions between Calendar Year 1996 and 1997





## 1996 Emissions by principal source category for individual pollutants

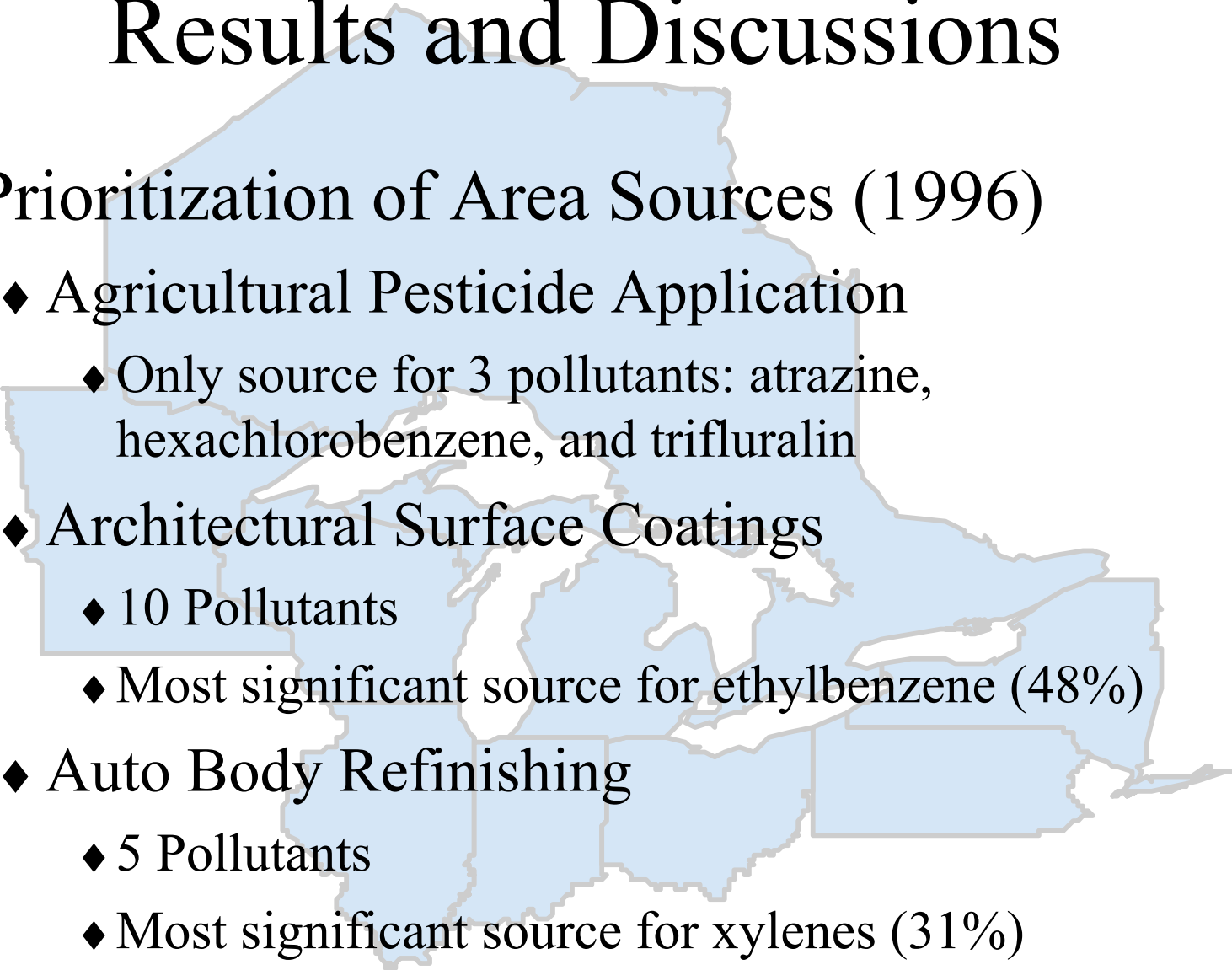
Pollutants Category	Estimated Number	> 2/3 Emissions		
		Point	Area	Mobile
PAHs	16	1	15	0
Non-Metal Compounds	49	27	7	7
Metal Compounds	12	10	1	0
<b>Total</b>	<b>77</b>	<b>38</b>	<b>23</b>	<b>7</b>

# The 1996 highest and the lowest emissions in the Great Lakes Region

<b>Pollutant</b>	<b>Emissions (lbs)</b>	<b>Ranking By Emissions</b>
Toluene	545,821,726	1
2,4,5-Trichlorophenol	0.02	77



# Results and Discussions

- 
- ◆ Prioritization of Area Sources (1996)
    - ◆ Agricultural Pesticide Application
      - ◆ Only source for 3 pollutants: atrazine, hexachlorobenzene, and trifluralin
    - ◆ Architectural Surface Coatings
      - ◆ 10 Pollutants
      - ◆ Most significant source for ethylbenzene (48%)
    - ◆ Auto Body Refinishing
      - ◆ 5 Pollutants
      - ◆ Most significant source for xylenes (31%)



## ◆ Prioritization of Area Sources

### ◆ Consumer and Commercial Solvent Use

- ◆ 15 pollutants
- ◆ Most noticeable contribution to glycol ethers (66%)

### ◆ Dry Cleaning

- ◆ 1 Pollutant - tetrachloroethylene
- ◆ Contribution of 80%

### ◆ Gasoline Marketing

- ◆ 12 Pollutants
- ◆ > 95% for 1,3-butadiene and di-n-butyl phthalate
- ◆ ~ 50% for ethylene dichloride and m-xylenes





## ◆ Prioritization of Area Sources

### ◆ Graphic Arts

- ◆ 9 Pollutants
- ◆ ~ 100% for 2,4-toluene diisocyanate

### ◆ Industrial Surface Coating

- ◆ 14 pollutants
- ◆ > 82% for ethylene dibromide, ethylene oxide and styrene
- ◆ 26% for toluene

### ◆ Landfills

- ◆ 25 Pollutants
- ◆ Unique source for acrylonitrile and PCBs

## ◆ Prioritization of Area Sources

### ◆ Marine Vessel Loading, Ballasting, and Transit

- ◆ 7 Pollutants

- ◆ Not significant for any pollutants

### ◆ Public Owned Treatment Works

- ◆ 19 Pollutants

- ◆ Responsible for most emissions of acetaldehyde, acrolein, chloroform, formaldehyde, and vinyl chloride

### ◆ Solvent Cleaning

- ◆ 11 Pollutants

- ◆ 48% - 64% for 1,1,1-trichloroethane, methylene chloride, and p-xylenes

- ◆ 98% for trichloroethylene

# ◆ Prioritization of Area Sources

## ◆ Chromium Electroplating

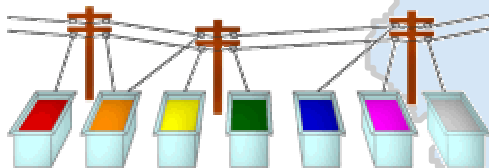
- ◆ 2 Pollutants

- ◆ Only source for chromium (6)

## ◆ Residential Fuel Combustion

- ◆ 35 Pollutants

- ◆ Primary source for all metals from area sources except for chromium (6)



## ◆ Prioritization of Area Sources

### ◆ Residential Wood Combustion

- ◆ 30 Pollutants

- ◆ Dominates area source emissions for all PAHs, benzene, phenol, TCDD, TCDF, PCDDs, PCDFs, and o-xylenes

### ◆ Traffic Marking


- ◆ 8 Pollutants

- ◆ Significant to carbon tetrachloride emissions (48%)



# Lesson Learned

- ◆ Regional coordination is an effective way
- ◆ Barriers and obstacles exist



GREAT LAKES REGIONAL AIR TOXIC EMISSIONS INVENTORY

# Lesson Learned

- ◆ Definitions - Not Consistent
  - ◆ Dependent on data collection methods
  - ◆ Difficult to compare emissions among states
- ◆ Guidance - Not Consistent and Not Comprehensive
  - ◆ Inadequate for all area source categories
  - ◆ Hard to judge appropriate emission factors
- ◆ Emission Trends - Not Representative

# Conclusions

- ◆ Area sources are significant contributors to the Great Lakes regional emissions of certain toxics
- ◆ Further improvement is needed for a more comprehensive and accurate inventory



Great Lakes



Toxics



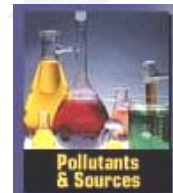
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